

AMENDMENTS TO THE CLAIMS

1. (currently amended) A communication device, which uses turbo codes as error-correction codes, comprising:

a transmitter that includes a turbo encoding unit which carries out a turbo encoding process ~~on lower bits of~~ a predetermined number of lower bits in transmission data ~~to~~ and outputs information bits ~~in accordance with the predetermined number~~ corresponding to the lower bits and first and second redundant bits that have been convolutionally encoded in different sequences, wherein the transmitter transmits the output of the turbo encoding unit and upper bits of the transmission data; and

~~a computing unit which carries out calculations for uniforming error correction capabilities on the respective information bits by using the information bits of the predetermined number and the redundant bits to output the results of the calculations and the other bits in the transmission data as the results of the encoding process;~~

a receiver that includes:

a first decoding unit which extracts the information bits and the first redundant bits from ~~the lower bits of the predetermined number in the~~ a received signal, and makes a soft-judgment on the lower bits based upon either the results of the extraction and a previous soft judgment output ~~that is an~~

~~output preceding by one given as preliminary information (in some cases, not given)~~ or only the results of the extraction;

a second decoding unit which extracts the information bits and the second redundant bits from the received signal, makes a soft-judgment on the lower bits based upon the results of the extraction and the soft-judgment output from said first decoding unit, and informs said first decoding unit of the results ~~thereof~~ of the soft-judgment as the previous soft-judgment output ~~preceding by one;~~

a first judging unit which ~~executes the soft-judgment by said first decoding unit and said second decoding unit a predetermined times repeatedly, and then estimates the original information bit~~ makes a hard-judgment on the lower bits based upon the soft-judgment output of said second decoding unit after the first and a second judging unit execute the soft-judgment repeatedly; and

a second judging unit which makes a hard-judgment on the ~~other~~ upper bits of the transmission data ~~is~~ based upon the received signal ~~to estimate the original information bits.~~

2. (original) The communication device according to claim 1, wherein said turbo encoding unit includes a deinterleave processing unit for carrying out a de-interleaving process on one group of the redundant bits that have been encoded after the interleave process

to output the respective information bits and the redundant bits with the times being coincident with each other.

3. (original) The communication device according to claim 1, wherein Reed Solomon codes and turbo codes are used combinedly, and on the transmitting side, the turbo encoding is carried out after the Reed Solomon encoding, while on the receiving side, the Reed Solomon codes are decoded after decoding the turbo codes.

4. (currently amended) A communication device comprising an encoder that uses turbo codes with the an interleave process being incorporated into ~~the~~ an encoding process, and outputs results of the encoding process,

said encoder includes,

a turbo encoding unit which receives transmission data constituted by a plurality of bits, and carries out a turbo encoding process on ~~lower bits of~~ a predetermined number of lower bits in the transmission data to output information bits in accordance with the predetermined number, including a first redundant bits ~~that have been being~~ obtained by convolutionally encoding the information bits and a second redundant bits ~~that have been being~~ obtained by convolutionally encoding the information bits after the interleave process; and

a computing unit which carries out calculations for uniforming error-correction capabilities on the respective information bits by using the information bits ~~of the predetermined number~~ and the redundant bits,

wherein the results of the calculations and ~~the other~~ upper bits in the transmission data are outputted as the results of the encoding process.

5. (original) The communication device according to claim 4, wherein said turbo encoding unit includes a deinterleave processing unit which carries out a de-interleaving process on the second redundant bits,

wherein the respective information bits, the first redundant bits and the second redundant bits that have been subjected to the de-interleaving process are outputted with the times being coincident with each other.

6. (original) The communication device according to claim 4, wherein Reed Solomon codes and turbo codes are used combinedly and the turbo encoding is carried out after the Reed Solomon encoding.

7. (currently amended) A communication device comprising an encoder that uses turbo codes with the an interleave process being

incorporated into ~~the~~ an encoding process, and outputs results of the encoding process,

said encoder includes a turbo encoding unit which receives transmission data constituted by a plurality of bits, and carries out a turbo encoding process on ~~lower bits of~~ a predetermined number of lower bits in the transmission data, and ~~to~~ outputs information bits ~~in accordance with the predetermined number corresponding to the lower bits, a first and a second redundant bit, the first redundant bits that have been being~~ obtained by convolutionally encoding the information bits, and the second redundant bits ~~that have been being~~ obtained by convolutionally encoding the information bits after the interleave process,

wherein, in addition to the respective information bits and the first and the second redundant bits, ~~the other upper~~ bits in the transmission data are outputted as the results of the encoding process.

8. (original) The communication device according to claim 7, wherein Reed Solomon codes and turbo codes are used combinedly and the turbo encoding is carried out after the Reed Solomon encoding.

9. (currently amended) A communication device comprising a decoder that decodes a received signal ~~that has been turbo encoded by using a soft judgment,~~ the received signal comprising information bits

and a first and a second redundant bit encoded based upon a predetermined number of lower bits of transmission data,

said decoder including,

~~a first decoding unit which extracts information bits and first redundant bits that have been convolutionally encoded from the lower bits of the predetermined number in the received signal, and makes a soft-judgment on the information bit based upon the received signal and a previous soft-judgment output based upon the results of the extraction and a soft judgment output that is an output preceding by one given as preliminary information (in some cases, not given);~~

~~a second decoding unit which extracts the information bits in accordance with the number of outputs on the encoder side and the second redundant bits that have been convolutionally encoded in a method different from the first redundant bits from the lower bits in the predetermined number in the received signal, makes a soft-judgment based upon the results of the extraction received signal and the soft-judgment output from said first decoding unit, and informs said first decoding unit of the results thereof of the soft-judgment as the previous soft-judgment output preceding by one;~~

~~a first judging unit which executes the soft-judgment by said first decoding unit and said second decoding unit a predetermined times repeatedly, and then estimates the original~~

~~information bit~~ estimates the lower bits of the transmission data
based upon the soft-judgment output of said second decoding unit
after the first and a second judging unit execute the soft-
judgment; and

a second judging unit which makes a hard-judgment on ~~the other~~
upper bits of the transmission data based upon a plurality of bits
in the received signal corresponding to ~~estimate the original~~
~~information~~ the upper bits of the transmission data.

10. (original) The communication device according to claim 9,
wherein, when Reed Solomon codes and turbo codes are used
combinedly on the transmitting side, the Reed Solomon codes are
decoded after decoding the turbo codes.

11. (currently amended) A communication method, which uses turbo
codes as error-correction codes, the method comprising:

a transmitting step that includes:

a turbo encoding step of carrying out a turbo encoding
process on ~~lower bits of~~ a predetermined number of lower bits in
transmission data ~~to~~ and outputs information bits ~~in accordance~~
~~with the predetermined number~~ corresponding to the lower bits and a
first and second redundant bits ~~that have been~~ convolutionally
encoded in different sequences; and

~~a computing step of carrying out calculations for uniforming error correction capabilities on the respective information bits by using the information bits of the predetermined number and the redundant bits to output the results of the calculations and the other bits in the transmission data as the results of the encoding process;~~

a receiving step that includes:

a first decoding step of extracting the information bits and the first redundant bits from ~~the lower bits of the predetermined number in the~~ a received signal so as to make and making a soft-judgment based upon either the results of the extraction and a previous soft judgment output ~~that is an output preceding by one given as preliminary information (in some cases, not given);~~

a second decoding step of extracting the information bits and the second redundant bits from the received signal so as to make and making a soft-judgment based upon the results of the extraction and ~~the~~ a soft-judgment output from the first decoding step, thereby ~~making~~ generating the results ~~thereof of~~ the soft-judgment as the previous soft-judgment output ~~preceding by one;~~

a first judging step of ~~executing the soft-judgment by the first decoding step and the second decoding step a predetermined times repeatedly, and then estimating the original~~

~~information bit~~ lower bits of the transmission data based upon the result of the soft-judgment output of generated in the second decoding step; and

a second judging step of making a hard-judgment on the ~~either upper bits in~~ of the transmission data based upon the received signal ~~to estimate the original information bits.~~

12. (original) The communication method according to claim 11, wherein the turbo encoding step includes a deinterleave processing step of carrying out a de-interleaving process on one group of the redundant bits that have been encoded after the interleave process,

wherein the respective information bits and the redundant bits are outputted with the times being coincident with each other.

13. (original) The communication method according to claim 11, wherein Reed Solomon codes and turbo codes are used combinedly, and on the transmitting side, the turbo encoding is carried out after the Reed Solomon encoding, while on the receiving side, the Reed Solomon codes are decoded after decoding the turbo codes.

14. (new) The communication device according to claim 1, further comprising a computing unit which carries out calculations for uniforming error-correction capabilities on the respective information bits by using the information bits corresponding to the

lower bits and the redundant bits, wherein the transmitter transmits the upper bits of the transmission data and transmits the results of the calculations by the computing unit as the output.

15. (new) The communication method according to claim 11, further including a computing step of carrying out calculations for uniforming error-correction capabilities on the respective information bits by using the information bits corresponding to the lower bits and the redundant bits, wherein, in the transmission step, the upper bits of the transmission data and the results of the calculations at the computing step are transmitted as the results of the turbo encoding step.